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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

- *with international search report*
- *with amended claims*

REMOTE MONITORING APPARATUS

TECHNICAL FIELD OF THE INVENTION

This invention relates to monitoring apparatus for use at a location which is geographically remote (distant) from a place or places where the occurrence of certain events is monitored.

BACKGROUND

By way of example, it is known to provide vending machines with a diagnostic system which collects data related to the operation of the machine. Such machines may also have an inbuilt telemetry system which allows the data to be periodically transmitted to a distant monitoring position, e.g. via a public telephone system, computer network etc. The data which is collected may be used for a variety of purposes. For example, if a fault condition occurs in an unattended machine an appropriate alarm can be generated. The data can also be used to monitor operation of the machine so that a service call can be arranged before a failure occurs. Thus, the usage of the machine could be monitored so that stocks of the products can be replenished before they run out. It is also possible to collect useful statistical data about the operation of the equipment which may be useful in

forward planning.

There are, of course, many other areas where one or more changeable parameters need to be monitored so that the occurrence of specific events can be signalled remotely. Examples include traffic flow monitoring at key places on the road network, diagnostic systems for monitoring the operation of unmanned plant and machinery, weather stations etc.

Although such telemetry systems are now quite widespread they currently have a number of disadvantages. For example, when calls are made via a public telephone system there can be considerable running costs in terms of call charges. Consequently it is normal to restrict the number of calls which are made so that data may only be passed infrequently, e.g. once a week, or in response to the occurrence of a specific condition, e.g. when stocks of the dispensed product are running low, when traffic flow falls below a specific speed etc. One consequence of this is that the data collected at the central monitoring location is usually out of date to a greater or lesser extent.

The present invention seeks to provide a new and inventive form of remote monitoring system which allows monitored events to be signalled whenever they occur whilst having a significantly lower running cost than conventional systems.

SUMMARY OF THE INVENTION

The present invention proposes remote monitoring apparatus provided with:

- sensing means for monitoring at least one parameter;

- information processing means responsive to said sensing means to produce a plurality of outputs in response to the occurrence of specific events; and

- a communication system capable of communicating via a telecommunication network with a number of remote terminals each of which is dedicated to handling a specific event, the communication system being responsive to the information processing means such as to communicate with the appropriate terminal when a relevant event occurs.

By providing such dedicated terminals it is possible to significantly reduce the amount of telemetric data which is exchanged. Thus, data can be collected more frequently with reduced operating overheads.

The telecommunication network may comprise a fixed and/or mobile (radio) communication system. The remote terminals may be installed at a common monitoring position and are preferably arranged to log incoming communications in a database.

The speed and operating costs can be minimised if the telecommunication network is provided with caller-identification whereby the network digitally transmits the identity of the originating system to the receiving terminal.

In some applications of the invention the sensing means may include a plurality of sensors arranged to monitor different aspects of the operation of the apparatus. In other cases a single sensor may be used to monitor a single parameter and the processing means is arranged to respond when the monitored parameter passes through specific conditions.

BRIEF DESCRIPTION OF THE DRAWINGS

The following description and the accompanying drawings referred to therein are included by way of non-limiting example in order to illustrate how the invention may be put into practice. In the drawings:

Figure 1 is a schematic diagram of a water cooler provided with a telemetry system in accordance with the invention; and

Figure 2 is a schematic diagram of remote traffic flow monitoring apparatus.

DETAILED DESCRIPTION OF THE DRAWINGS

In the first embodiment which is shown in Fig. 1 the invention is applied to apparatus for dispensing a product. In general, such products may include liquids as in a water cooler or drink dispenser, unwrapped articles such as bubble gum or sweets, or packaged articles such as cans of drink, chocolate bars etc. The product may be dispensed on demand as in an office water cooler or they may only be dispensed upon receipt of an appropriate payment made by cash, tokens, credit card etc. By way of illustrative example the drawing shows a water cooler 1 in which water is supplied from a bottle 2 to a reservoir 3 which is chilled by a refrigeration system 4. Chilled water is dispensed from a manually-operable discharge valve 5 via a flow sensor 6. The cooler is powered from an AC supply 8 through a power supply unit 9, and includes an electrical control unit 10. The water cooler also includes a stack of cups 7 which users can remove one by one.

A diagnostic unit 12 is installed within the cooler to process the incoming sensory information and monitor various aspects of its operation. The diagnostic unit receives signals from a number of sensory inputs throughout the cooler by means of which the following conditions are monitored:

- The flow sensor 6 allows usage of the cooler to be monitored in terms of the volume of chilled water dispensed. A real time clock 13 allows the diagnostic unit to record usage against time.
- A sensor 20 detects faults in the water system. For example, a leak may be signalled by detecting the presence of air in the reservoir 3.
- Faults in the refrigeration system 4 are detected and signalled to the diagnostic unit.
- The diagnostic unit responds to the occurrence of an electrical fault in the main control unit 10.
- A power failure resulting in loss of power at the power supply unit 9 is detected. The diagnostic unit receives back-up power from a bank of trickle-charged cells 24.
- An opto-electronic or electro-mechanical sensor 22 signals when the store of cups 7 is becoming low and needs to be replenished.

In the event that a fault condition is detected or another specified event occurs (e.g. upon each litre of water dispensed) the diagnostic unit 12 signals an in-built communication system in the form of a cellular telephone transceiver 26 to initiate a call. The number which is called depends on the nature of the fault, each fault condition being assigned its own unique destination number. The call is received by a satellite or terrestrial receiving station 27 which is linked to a public telephone network, indicated at 28. The network preferably has caller-identification capability by which the originating

telephone number is digitally signalled to the call destination. The call is routed to one of a number of modem terminals 29 depending on the number which is called. The modems will usually (but not necessarily) be installed at a single monitoring position and all incoming data is logged in a central database 30. On receipt of a call the modem detects the ringing signal and decodes the caller identification data to log the identity of the originating water cooler and the time of the call. Since the telephone transceiver 26 has its own unique number numerous similar water coolers can be connected to the system but the identity of each will be known from the caller-identification information.

It will now be apparent that the identity of the cooler and the nature of the fault are now known at the remote monitoring position even though the call has not yet been answered. Indeed, the call need not be answered, although in practice it will usually be desirable for the modem to return a brief acknowledgement signal to confirm that the call has been logged. Telemetric data can also be exchanged in either direction if desired, for example to give the central location additional information on the nature of the event which has occurred or to send a reset command to the water cooler. Once any exchange of data is complete the call is terminated.

The telephone unit 26 also has battery backup to maintain operation in the event of a power failure. Usage information can be transferred to the appropriate dedicated modem terminal 29 at regular intervals and/or in response to specific usage conditions.

The bank of modems 29 can automatically respond to a call by signalling an appropriate alarm condition, issuing a request for a maintenance call, or

generating another appropriate response according to the nature of the condition to which they are set up to respond. The database thus contains up-to-date information on the status of all the coolers connected to the system. Accurate and up-to-date reports and statistics can be generated as required. Moreover, the information is obtained with a substantially lower running costs compared with existing systems.

The second embodiment shown in Fig. 2 illustrates how such a telemetric system may be applied to apparatus of the kind which monitors a single parameter, in this case traffic flow. The apparatus includes a speed sensor 51 which is mounted at the roadside in a strategic position to monitor the speed of passing vehicles, e.g. using the doppler shift principle. The sensor generates an output signal representing vehicle speed, which is passed to a processing unit 52. This unit is programmed to assign the incoming speed readings to predetermined speed ranges and analyse the accumulated data to determine the average vehicle speed. Whenever the average speed drops below a specific figure the processor 52 signals a GSM module 53 to make a call via an appropriate data line 54. For example, one line may output a signal when the traffic speed drops below 60 mph, another line may become active when the speed drops below 50 mph, a third line may respond at 40 mph, and so on. The lines may be private terrestrial links, telephone lines via a public terrestrial and/or radio network, satellite links etc.

A regional data centre 55 equipped with Caller Line Identifier facilities (CLID) receives the incoming signal lines and logs the vehicle speed as indicated by line on which the call was made and the time of receipt in a database 56. The database thus provides accurate and up-to-date information on the present traffic flow conditions at all strategic points in the region. Again, the call need

not be answered, although it may be desirable to return an acknowledgement signal to confirm that the call has been logged. Telemetric data can again be exchanged in either direction if desired, but even so, the running costs are substantially reduced.

It will be appreciated that the features disclosed herein may be present in any feasible combination. Whilst the above description lays emphasis on those areas which, in combination, are believed to be new, protection is claimed for any inventive combination of the features disclosed herein.

CLAIMS

1. Remote monitoring apparatus provided with:
 - sensing means for monitoring at least one parameter;
 - information processing means responsive to said sensing means to produce a plurality of outputs in response to the occurrence of specific events; and
 - a communication system capable of communicating via a telecommunication network with a number of remote terminals each of which is dedicated to handling a specific event, the communication system being responsive to the information processing means such as to communicate with the appropriate terminal when a relevant event occurs.
2. Remote monitoring apparatus according to Claim 1, in which the remote terminals are installed at a common monitoring position.
3. Remote monitoring apparatus according to Claim 2, in which the remote terminals are arranged to log incoming communications in a database.
4. Remote monitoring apparatus according to Claim 1, in which the telecommunication network is provided with a caller-identification facility by which the network digitally transmits the identity of the originating system to the receiving terminal.
5. Remote monitoring apparatus according to Claim 1, in which

the sensing means includes a plurality of sensors arranged to monitor different operating parameters.

6. Remote monitoring apparatus according to Claim 5, in which the apparatus is arranged to monitor various operating parameters of equipment for dispensing a product.

7. Remote monitoring apparatus according to Claim 6, in which the equipment is of the kind in which liquid is supplied from a bottle to a discharge outlet via a reservoir.

8. Remote monitoring apparatus according to Claim 7, in which the reservoir includes means for cooling the liquid therein.

9. Remote monitoring apparatus according to Claim 1, in which a single sensor is provided to monitor a single operating parameter and the processing means is arranged to respond when the monitored parameter meets specific conditions.

10. Remote monitoring apparatus according to Claim 1, in which the telecommunications network includes a mobile telephone system and the communication system incorporated in the apparatus includes a radio transmitter.

AMENDED CLAIMS

[received by the International Bureau on 15 May 2002 (15.05.02);
original claims 1-10 replaced by amended claims 1-11 (3 pages)]

1. Equipment for dispensing a liquid which is supplied from a bottle to a discharge outlet via a reservoir,

characterised by

remote monitoring apparatus provided with:

- sensing means which includes a plurality of sensors arranged to monitor different operating parameters of said equipment;

- information processing means responsive to said sensing means to produce a plurality of outputs in response to the occurrence of specific events; and

- a communication system capable of communicating via a telecommunication network with a number of remote terminals each of which is dedicated to handling a specific event, the communication system being responsive to the information processing means such as to communicate with the appropriate terminal when a relevant event occurs.

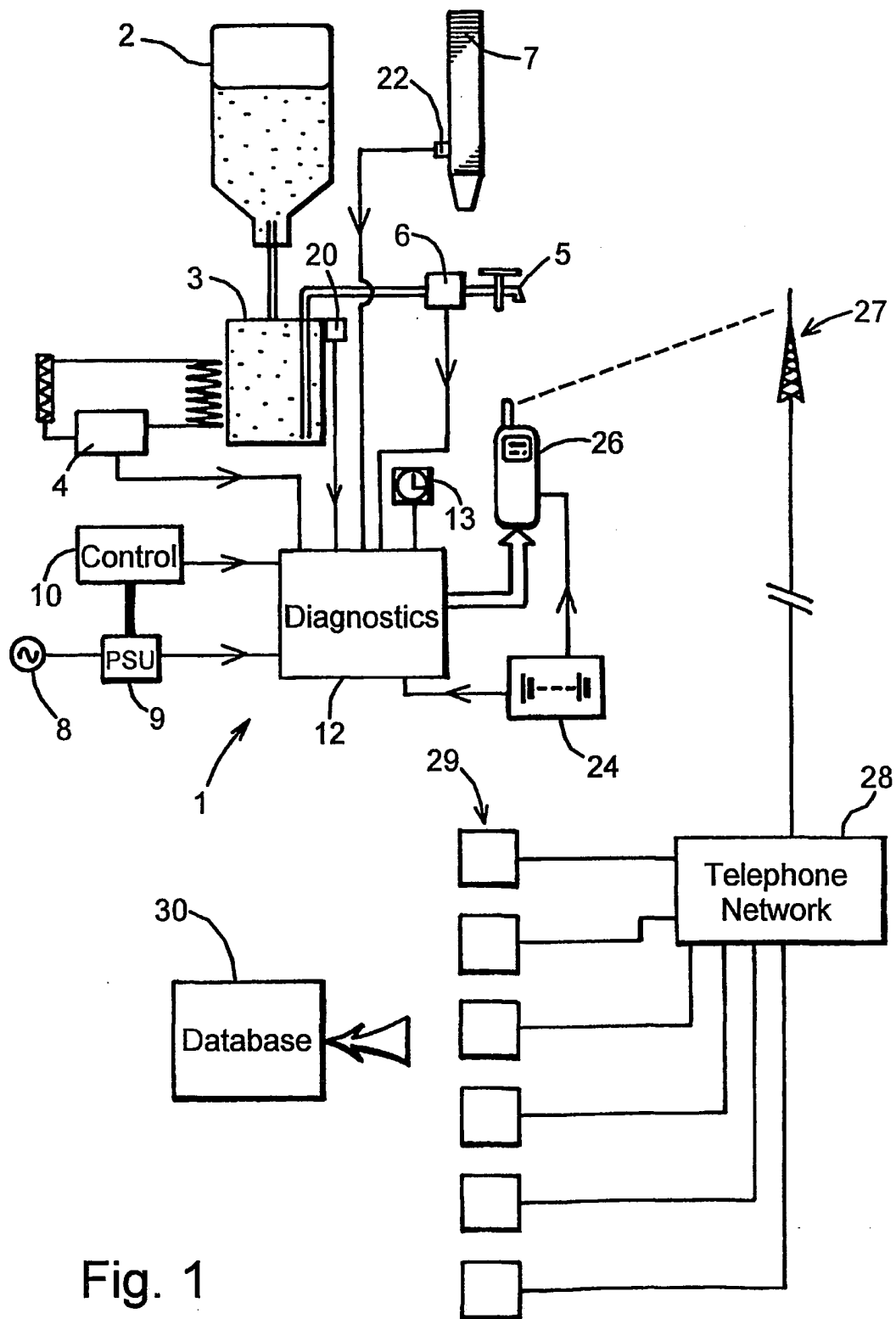
2. Equipment for dispensing a liquid according to Claim 1, in which the remote terminals are installed at a common monitoring position and are arranged to log incoming communications in a database.

3. Equipment for dispensing a liquid according to Claim 1, in which the telecommunication network is provided with a caller-identification facility by which the network digitally transmits the identity of the originating system to the receiving terminal.

4. Equipment for dispensing a liquid according to Claim 1, in which the sensing means includes a sensor which is arranged to monitor the volume of liquid dispensed.
5. Equipment for dispensing a liquid according to Claim 1, in which the reservoir includes means for cooling the liquid therein.
6. Equipment for dispensing a liquid according to Claim 5, in which the sensing means is arranged to detect faults in said means for cooling the liquid in the reservoir.
7. Equipment for dispensing a liquid according to Claim 1, in which the sensing means includes a sensor which is arranged to detect leakage of liquid.
8. Equipment for dispensing a liquid according to Claim 1, which includes an electrical control unit and the sensing means responds to the occurrence of an electrical fault in said control unit.
9. Equipment for dispensing a liquid according to Claim 1, which includes a power supply unit and the sensing means is arranged to detect a power failure resulting in loss of power at said power supply unit.
10. Equipment for dispensing a liquid according to Claim 1, which includes a store of cups and the sensing means includes a sensor which is arranged to detect when the number of cups is low and needs to be replenished.

11. Equipment for dispensing a liquid according to Claim 1, in which the telecommunications network includes a mobile telephone system and the communication system incorporated in the apparatus includes a radio transmitter.

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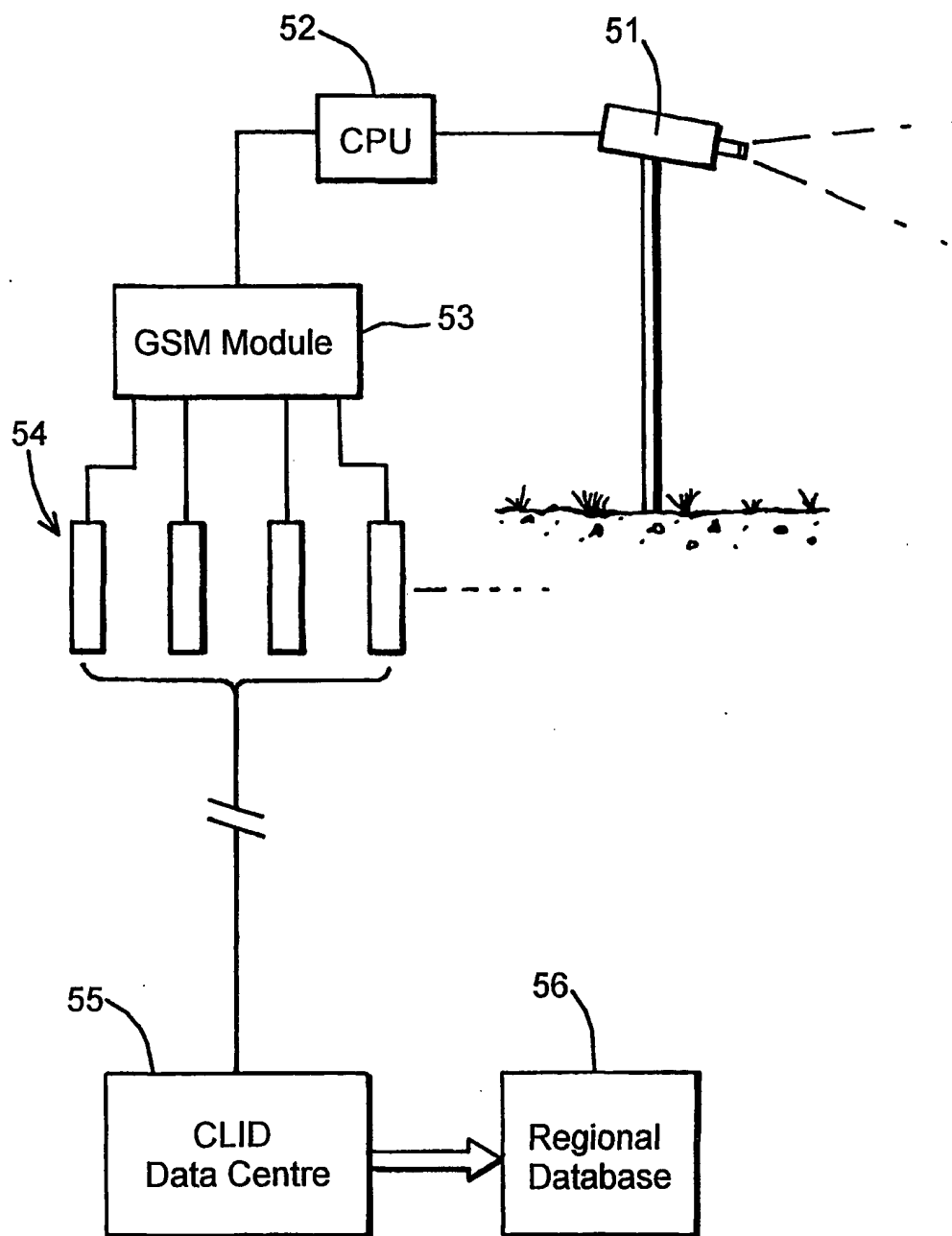


Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 01/05401

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04M11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 784 441 A (PATTON MARK WAYNE ET AL) 21 July 1998 (1998-07-21) column 4, line 63 -column 8, line 19	1,2,4,9
X	US 6 061 430 A (MARX ADAM N ET AL) 9 May 2000 (2000-05-09)	1,2,4,5
Y	column 3, line 39 -column 4, line 37 column 4, line 64 -column 6, line 57	3,6-8,10
Y	WO 98 24078 A (KNIGHT RICHARD ROBERT ;PARKINSON DAVID WILLIAM (GB); BRITISH TELEC) 4 June 1998 (1998-06-04) page 5, line 12 -page 6, line 20 page 12, line 27 -page 13, line 23	3,6-8,10
A	US 5 608 643 A (ROSS JACK A ET AL) 4 March 1997 (1997-03-04) column 3, line 52 -column 6, line 8	1-10



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 01/05401

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			WO 9607145 A1	07-03-1996